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Storm water screening

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Abstract

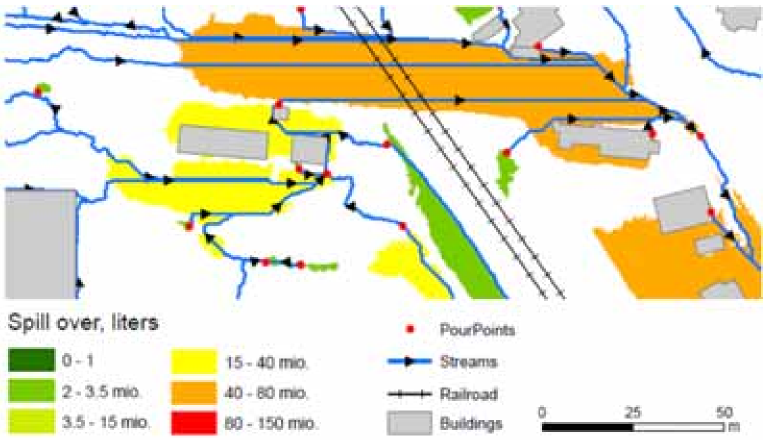
Climate changes cause severe problems worldwide due to more frequent rain storms. Fortunately, several highly sophisticated models are available to model the floods and estimate the impacts. However, much information is required to run them so they become immense and time consuming to handle. Also, it is extremely computer demanding to process new generation of high-resolution elevation models if an application is based on raster tools, only. The consequences are that only a minority have such systems available. Especially, in schools of higher education only very few hydrogeologic departments have such setups causing other planners like geographers, landscape architects and surveyors never to get introduced to overall basic hydrologic modeling in practice. If merely a basic screening application could be available providing the bigger overview of rain storm impacts, more planners could enter the discussions when new site developments are considered and judge whether a location has obvious flood potentials or not.

An attempt to build a simple screening application modelling Horton flow conditions has been developed by combining the raster, vector and geometric network GIS data models. Assuming no soil infiltration is, of course, a rough generalization of the real world conditions. However, when rain intensities are very high and the sewer systems (if present) get out of control, almost all precipitation is turned into overland flow, anyway.

The initial screening steps are, still, based on basic raster tools to detect local landscape sinks, their capacities and local catchments within an overall drainage basin. Next, the sinks' pour points are located, converted to points and assigned the values for the sinks' capacities and the volumes entering the sinks from the local catchments during a rainstorm. Also, all streams carrying the downstream spillover are identified and converted to polylines. In a third step a geometric network is established from the pour points as junctions and the spillover streams as edges. In a fourth step a custom tracing tool is executed to calculate the nested spillover from sink to sink based on weights assigned to the network. Finally, the results for the accumulated flow and the volumes in the sinks after a specific rain event are visualized.

Currently, a terrain model is the only input. However, a buildings feature class may be added revealing if any house is located critically in a sink or along major water corridors. So far the method has been used to screen the Danish 0.4 m terrain model, but lower-resolution models have been processed successfully, too. The workflow will be shared as a resource for ArcGIS Desktop and Pro users in 2017, and the Danish Agency for Data Supply and Efficiency (SDFE) is currently sponsoring a conversion of all models into open source Python-plugins for QGIS.

The presentation will demonstrate the setup and discuss the cons and pros of using such simplified non-dynamic models vs. dynamic raster models in storm water impact assessments.



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